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Benefits of Completion ceCBCT After EVAR

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Introduction: The aim of this study was to compare contrast enhanced cone-beam computed tomography (ceCBCT) to completion angiogram following endovascular aneurysm repair (EVAR).

Methods: All patients treated with bifurcated or fenestrated and branched endografts in our hybrid room during the study period were included. From December 2012 to July 2013, a completion angiogram (CA) was performed at the end of the procedure, and a Computed Tomography Angiography (CTA) before discharge (group 1). From October to December 2013, a completion ceCBCT was performed at the end of the procedure and a contrast-enhanced ultrasound (CEUS) during the 30-day postoperative period (group 2). The rate of perioperative events, including type I or III endoleaks, kinks or occlusions of target vessels and bridging stents, need for additional procedures or early secondary procedures, and global radiation exposure (mSv) and total volume of contrast medium injected were analyzed and compared.

Results: Seventy-nine patients were included in group 1 and 54 in group 2. Perioperative events rate were respectively 10.1% (8/79) in group 1 and 33.3% (18/54) in group 2 ($p = 0.001$). Additional procedures were performed in 7 patients (8.9%) in group 1 and 17 (31.5%) in group 2 ($p = 0.001$). Two early secondary procedures were performed in group 2 (3.7%), and 3 (3.8%) in group 1 ($p = 0.978$). Median radiation exposure due to the ceCBCT was 7 Gy.cm^2 (5.25—8) (39%, 27% and 11% of the total procedure radiation exposure, respectively for bifurcated, fenestrated and branched endografts). CEUS never diagnosed endoleaks or any adverse events not diagnosed by ceCBCT. Global radiation and volume of contrast injected during the patient hospital stay in group 1 and 2 were 34 (25.8—47.3) and 11 (5—20.5) mSv, and 184 (150—240) and 91 (70—132.8) mL respectively (reduction of 68%, $p < 0.001$ and 50%, $p < 0.001$).

Conclusion: Completion ceCBCT is achievable in routine practice to assess technical success after EVAR. It offers the opportunity to perform additional treatment during the primary procedure and reduces the need for a postoperative CTA, thus reduces total in-hospital radiation exposure and contrast media volume injection.

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Number and Location of Abdominal Aorta Entry Tear is Associated with Abdominal Aorta Remodeling After Stent Grafting for Complicated Type B Aortic Dissection

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Introduction: Thoracic endovascular aorta repair for complicated type B aortic dissection is a challenging issue in last decade. The remodelling process of aorta false lumen is still unknown and hard to predict, especially in the abdominal aorta part. In this study, we try to find out some impact factors from retrospective analysis in our patient group.

Methods: From November 2006 to July 2012, 84 patients received thoracic stent graft implantation +/− cervical bypass due to complicated type B aortic dissection in our institute. 73 of them had regular post-operative contrast computed tomography scan follow up more than 1 year and then were included in our study. Most of the (71 of 73) false lumen in thoracic aorta got total thrombosis or obliterated without any contrast. However, the false lumen of abdominal aorta got total thrombosis or obliterated without any contrast only in 27 of 73 patients (regression group) while the false lumen were still patent in other 46 patients (non-regression group). We measured the number and the location (thoracic aorta, supra-renal aorta, infra-renal aorta, iliacs) of all entry tears in pre-operative computed tomography scan and compare the results between two groups.

Results: Pre-operative number of entry tear in abdominal aorta is significantly higher in non-regression group (3.36 ± 2.26 versus 1.22 ± 1.15, $P < 0.001$). Fewer entry tears are found over supra-renal aorta in regression group. (1.54 ± 1.18 versus 0.56 ± 0.75, $P < 0.001$) The incidence of distal stent graft induced new entry is much higher in non-regression group ($P < 0.05$).

Conclusion: The number and the location of entry tear are the predictors of abdominal aorta remodelling after TEVAR for complicated type B aortic dissection. If pre-operative number of entry tear in abdominal aorta, especially supra-renal aorta, is fewer, the remodelling of dissected aorta after TEVAR will process better.

Performance of Bridging Stent-grafts in Fenestrated and Branched Aortic Endografting

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Introduction: Bridging stent-grafts (BSGs) are used to connect the target vessel with the main body during fenestrated or branched aortic endografting (f/bEVAR). At present, no dedicated device is available as BSG and different combinations of stent-grafts and relining stents have been proposed. Aims of this study were to assess the performance of the BSGs and to address potential risk factors for poor outcomes.

Methods: Between 01/2010 and 03/2014, 150 consecutive patients underwent f/bEVAR and 515 target vessels were revascularized. Main measure outcome was any BSG-related complication. A logistic regression analysis including target vessel type, type of endografting (fenestrated or branched) and type of BSG identified potential risk factors for the main measure outcome.

Results: The main body consisted of only fenestrations in 72 patients (48%), only branches in 68 patients (45%) and a combination of both in 10 patients (7%). Fenestrated devices were implanted mainly by Crawford type 4 and juxtarenal aneurysms ($n = 57$, $p < 0.001$). The target vessels included 104 celiac-, 139 superior mesenteric-, 268 renal- and 3 other arteries. The technical success amounted to 99.6% (511 out of 515 target vessels). Balloon expandable BSG were mainly used (*n* 490, 95.7%) and in 329 was relining stent combined (64.4%). Main reasons for technical failure were the dislocation of the main body ($n = 2$) and unsuccessful cannulation ($n = 2$). One could be revascularized by means of the periscope technique. Three renal arteries in two patients (0.5%) occluded perioperatively.

After a mean follow-up of 11 months (range 1–41), 5 other renal artery occlusions (0.9%) occurred and 17 BSG-reinterventions (3%) were performed (Figure: residual distal type 1 endoleak celiac artery after renal extension). No SMA occlusion was reported. The patency and freedom-from-reintervention rate at 2 years amounted to 97% and 93% respectively.

Revascularization of the renal artery and use of a branched main body were the only independent risk factors for occlusion (odds ratio: 11.7; 95% CI: 1.4–91.9 $P = 0.03$ and 3.4; 95% CI: 0.9–13.3 $P = 0.03$, respectively). The branched main body was also risk factor for reintervention (odds ratio 4.0; 95% CI: 1.2–13.4 $P = 0.002$). Of note, use of relining stents seems not to prevent BSG-related complications.

Conclusion: The currently used BSGs are showed low occlusion and reintervention rates. Outcomes after bEVAR and revascularization of the renal arteries might be improved by means of a dedicated device. SMA-related complications are rare or probably underestimated due to the associated mortality.

Angulation of the C-arm During Complex Endovascular Aortic Procedures Increases Radiation Exposure to the Head

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Introduction: Reliance on endovascular techniques and increasing procedural complexity means that the vascular interventionalist is exposed to significant radiation doses, particularly to unprotected body parts. We aimed to directly measure head and body radiation exposure to the operating team during complex endovascular aortic procedures.

Methods: Between November 2013 and April 2014, consecutive elective branched and fenestrated endovascular aortic repairs (EVAR) performed in a hybrid operating theatre were prospectively analysed. Body (over-lead and under-lead) and head doses were measured for the primary (PO) and assistant operator (AO) using electronic dosimeters (Hitachi-Alokai). Fluoroscopy time, digital subtraction angiography (DSA) acquisition time, C-arm angulation and dose area product (DAP) were recorded. Data were analysed using Mann–Whitney *U* test and logistic regression modelling.

Results: Twelve cases were analysed (Crawford II [$n = 3$], Crawford III [$n = 2$], Crawford IV [$n = 7$]), with a median operative time of 230min (IQR 180–308). Median age was 76 yr (71–80); median body mass index was 28.6 kg/m^2 (25.4–32.0); 85% male. Stent grafts incorporated branches only ($n = 4$), fenestrations only ($n = 6$) or a mixture of branches and fenestrations ($n = 3$). A total of 17 branches and 24 fenestrations were cannulated and stented.

Head dose was significantly higher in the PO compared with AO (53 μSv [19–106] versus 10 μSv [6–25], respectively; $p = 0.014$), as was over-lead body dose (87 μSv (43–114) versus 9 μSv (5–36), respectively; $p = 0.003$). The corresponding under-lead doses were similar between operators ($p = 0.241$). Left anterior oblique ($r^2 = 0.53$; $p = 0.009$) and cranial ($r^2 = 0.63$; $p = 0.007$) C-arm angulation, and time to cannulation of the superior mesenteric artery ($r^2 = 0.62$; $p = 0.01$) were predictors of greater PO head dose exposure.

Conclusion: The head is an unprotected area that receives a significant radiation dose during complex EVAR. The deleterious effects of exposure to this area are not fully understood. Operators should be cognisant of head exposure increasing with angulation of the C-arm and limit this manoeuvre.

Preliminary Results from a Multicenter Registry of Infection in Abdominal Aortic Endovascular Repair (R.I.-EVAR)

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Introduction: Objective: to report on epidemiology, risk factors, diagnosis, treatments and outcomes in a series of patients previously treated by EVAR and with an infection diagnosed from 1 to 72 months after endograft implantation, collected by the Italian Registry of Infection in EVAR (R.I.-EVAR).

Methods: From June 2012 to October 2013 twenty-six cases of abdominal aortic endograft infection were recorded. Cases collected were available for patients submitted to EVAR implantation from January 2004 to June 2013. Comparative perioperative and long-term mortality rate analysis was performed with respect to type of infection treatment, presence of aorto-enteric fistula, type of endograft employed and presence of risk factors for infection. Significance was set at $p < 0.05$.

Results: Mean time from EVAR treatment to infection diagnosis was 20.5 ± 20.3 months (range 1–72). In 6 cases (23.1%) an aorto-enteric fistula (AEF) was detected. Positive tissue cultures were found in 76.9% of patients. More than 1 infectious agent was found in 19.3% of cases. EVAR infection treatment was conservative in 4 cases, endovascular in 2. Endograft excision was performed in 10 cases by conventional treatment (aortic stump + extra-anatomic bypass) and in 10 cases by in situ reconstruction (cryopreserved allograft or rifampicin-soaked silver Dacron graft). Overall mortality was 50% in all treatment groups. 30-day mortality was 38.4% (10/26 cases). Four patients with AEF died in the first month following treatment (66.6%). Mean time from infection treatment to infection-related death was 1.25 ± 0.62 months. Suprarenal endografts required a more proximal aortic cross-clamping for removal and were burdened by higher mortality rates than infrarenal endografts ($p = 0.01$). No significant difference was encountered in 30-day and overall mortality respect to presence of risk factors and presence of AEF. Total survival after infection treatment in 13 cases was 27.9 ± 22.4 months (range 2–74).

Conclusion: EVAR infection diagnosis is burdened by extremely high mortality rates. Prospective registries could help monitoring outcomes in EVAR infection patients and possibly developing new surveillance protocols. Preventive treatment strategies are needed and should be developed in close collaboration with industries.